Diagnostics for the SFOF Mark IIIA Central Processing System: Pre-Mission CPS/Facility Checkout Procedures

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Prior to critical periods of mission processing, comprehensive diagnostic tests of the SFOF central processing system are conducted to detect and correct equipment deficiencies before they can affect the continuity of spaceflight data processing. The article describes the test methods employed in their relationships to the current dual IBM 360/75 computer configuration. By preparing a test "script" in advance, the hardware checkout process is formalized and the results documented.

I. Introduction

Prior to periods of critical mission data processing, it is worthwhile to conduct a comprehensive series of diagnostic tests to isolate and remedy equipment malfunctions. These diagnostics provide standard criteria and uniform methods for verifying the technical conditions of all critical computer-related hardware in the SFOF central processing system (CPS). In the past, such tests have been performed immediately prior to most launch, midcourse and encounter operations for *Mariner*, *Surveyor*, *Pioneer* and *Lunar Orbiter* missions. They are also planned in support of the *Mariner* Mars 1971 mission.

It has been the custom to prepare a detailed script for each checkout to reflect the mission-committed hardware configuration, the test durations and the procedural sequences. When completed, this itemized record can be used as the basis for system buyoff and a formal pre-mission transfer to the responsible operational organization.

The first two articles in this series (Refs. 1 and 2) have described the various types of diagnostic routines which presently exist for the IBM 360/75-related portion of the CPS. A full set of compatible diagnostics are currently operable under the diagnostic monitor (DIAMON) which supervises their execution under the overall control of the JPL operating system (JPLOS).

II. Objectives

CPS diagnostic checkouts serve the following purposes:

(1) Verifying performance of newly installed equipment.

(2) Certifying the condition of previously installed equipment.

(3) Exercising hardware elements individually to expose suspected faults.

(4) Training personnel in a "hands-on" environment.

(5) Resolving many uncertainties concerning alleged hardware-versus-software problems.

(6) Uncovering marginal performance.

(7) Correcting system deficiencies.

(8) Formalizing hardware acceptance.

III. Mark IIIA CPS Configuration

Figure 1 identifies the 360/75-related elements of the Mark IIIA CPS as they exist in SFOF at the present time (Ref. 3). Not shown are numerous user station devices which are installed in the various mission support areas, the DSN monitor area, and the DSN operations control area on the first floor of the SFOF. In substance, the two 360/75 central processing units (CPUs) may be considered identical and interchangeable, with input/output lines and user terminal and display (UTD) devices switchable between the two. Switching control is vested with the computer chief (or system controller) in the data processing control center (DPCC). Transfer is accomplished through two DPCC consoles: (1) a user device switching console, and (2) a GCF high-speed data/wideband data (HSD/WBD) switching console. DPCC personnel are also provided with monitoring and entry devices such as display stations, line printers, and a card reader.

Diagnostic testing involves all of the equipment elements shown in Fig. 1 plus:

(1) The communications processor (CP) teletype (TTY) input/output (I/O) interface with GCF.

(2) The HSD I/O interface with GCF.

(3) The WBD input interface with GCF.

(4) The Univac 1108A and 1108B I/O interface with the scientific computing facility (SCF).

(5) The Control Data 3100 output interface for UTD DTV displays.

(6) The mission display board (MDB) interface to the UTD Vigicon projectors.

(7) The SFOF time reference interface for GMT displays and CPU timers.

(8) Numerous 360/75-driven UTD user devices throughout the SFOF.

There are also 360/75-to-360/75 channels, not presently utilized, and additional peripherals for administrative computing section support. These are not part of the committed mission configuration and thus are not discussed here.

IV. Diagnostic Checkout Procedures

Prior to each checkout period, a plan or script is prepared to assure that testing will proceed in an orderly manner, will cover all committed equipment, and will be properly documented. The script:

(1) Formalizes the sequence of testing.

(2) Gives the required calls (2260 display station requests) for manual entry by the operator.

(3) Specifies a suggested duration for each of the tests (number of data blocks, characters, transfers, etc.).

(4) Fixes optimal data patterns.

(5) Indicates the expected message responses and error printouts.

(6) Identifies variations, or options, for each test.

(7) Provides a checkoff column for logging test results.

(8) Acts as a training aid for participating personnel.

(9) Is a debriefing medium for post-test critiques.

(10) Provides a basis for system buyoff and transfer.

At the outset of testing, the SFOF time reference and internal CPU timer registers are usually checked first as they are fundamental to all subsequent system testing. Since the test director usually operates from the data processing control center (Fig. 1), DPCC devices are generally tested next. Following this, other diagnostics may be initiated in parallel for concurrent execution. (The

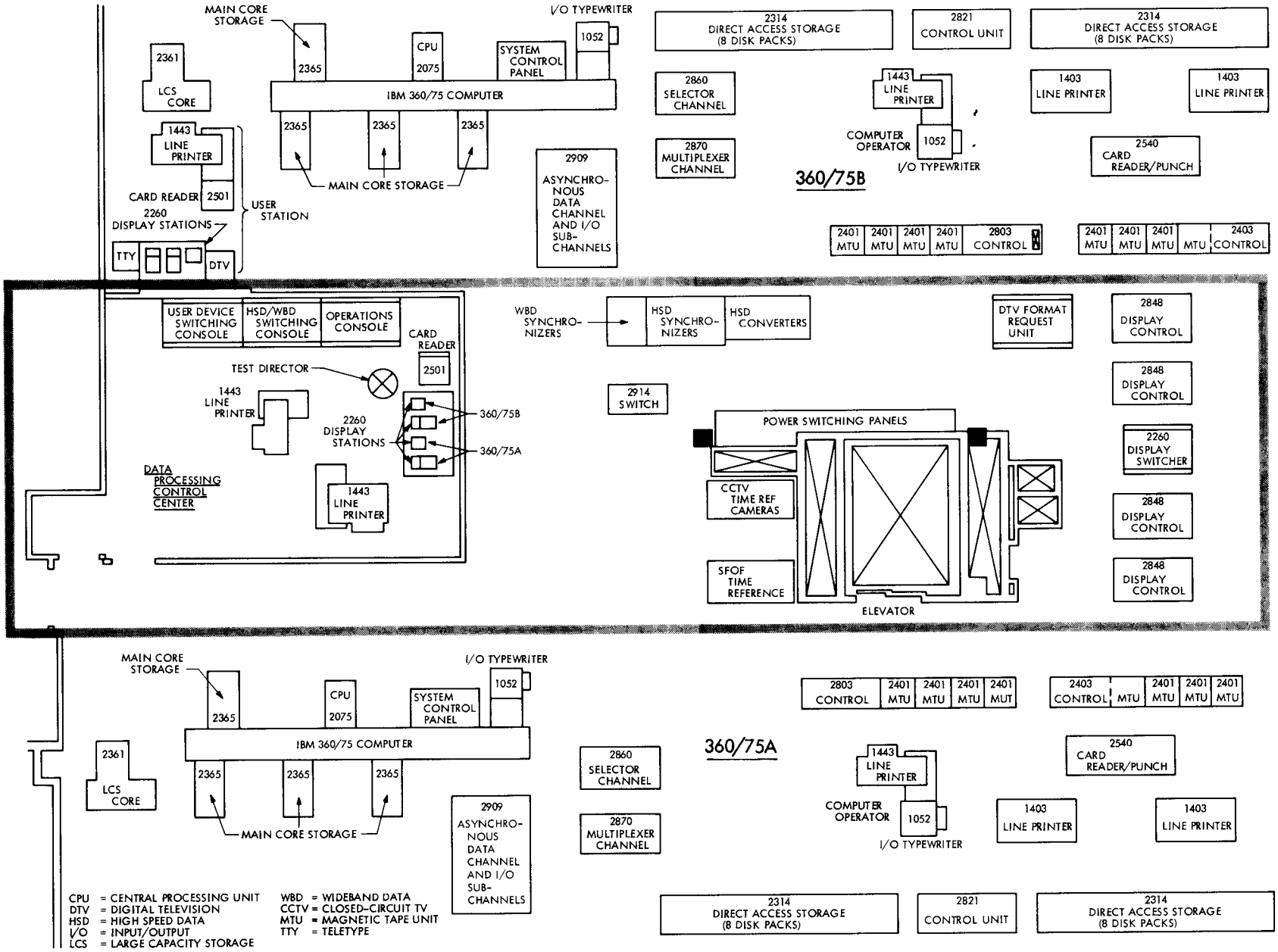

Fig. 1. SFOF Mark IIIA 360/75-related central processing system equipment layout

present diagnostic implementation requires total dedication of the system elements being tested).

All DIAMON-related diagnostics are resident under JPLOS and are available for use by SFOF operations personnel as required.

V. Conclusion

In brief, these scheduled pre-mission checkouts are conducted periodically from published scripts. Diagnostic requests are entered via 2260[1] display station keyboards, DIAMON messages are displayed on 2260 CRTs, and a hard-copy log is provided on the designated line printer(s).

Full-scale tests, such as described in this article, are scheduled upon request to assure optimum system performance in support of JPL's mission support commitments.

[1]Also known as manual entry devices (MED).

References

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3. Stiver, R. A., "Mark IIIA IBM 360/75 Computer Configuration," in *The Deep Space Network,* Space Programs Summary 37-66, Vol. II, pp. 71–75. Jet Propulsion Laboratory, Pasadena, Calif., Nov. 30, 1970.